

Bay Area Air Quality Management District
939 Ellis Street
San Francisco, CA 94109

Proposed Amendments to

**Regulation 8, Rule 4:
General Solvent and Surface Coating Operations**

**Regulation 8, Rule 14:
Surface Coating of Large Appliances and Metal Furniture**

**Regulation 8, Rule 19:
Surface Coating of Miscellaneous Metal Parts and Products**

**Regulation 8, Rule 31:
Surface Coating of Plastic Parts and Products**

**Regulation 8, Rule 43:
Surface Coating of Marine Vessels**

Staff Report

September 13, 2002

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EXECUTIVE SUMMARY

The 2001 San Francisco Bay Area Ozone Attainment Plan (2001 Plan) calls for the reduction of volatile organic compounds (VOC's) to enable the Bay Area to attain the 1-hour national ozone standard. The 2001 Plan includes various control measures for stationary and area sources based on emission reduction opportunities identified during the plan development. Control measure SS-13, Surface Preparation and Cleanup Standards for Metal Parts Coating, is intended to reduce the use of solvent in cleaning and preparing surfaces for coating. Most of this solvent is used in handwiping operations. Existing surface coating rules in Regulation 8: Organic Compounds limit the VOC content allowed in various types of coatings, but do not limit VOC content of surface preparation and cleanup solvents. The existing surface coating rules are targeted at specific industries, based on an assessment of the technologies that can be implemented to reduce VOC's for each type of industry. SS-13 identified two rules in Regulation 8, Rule 14: Surface Coating of Metal Furniture and Large Appliances, and Rule 19: Surface Coating of Miscellaneous Metal Parts and Products, for additional emission reductions based on the use of low VOC content solvents for surface preparation and cleanup. The 2001 Plan projects emission reductions of 0.3 tons/day from an inventory of 0.5 tons/day at a cost effectiveness of \$1,100 per ton VOC reduced.

This proposal implements and expands upon control measure SS-13 from the 2001 Plan. The proposed amendments impose VOC limits on surface preparation and cleanup solvent use associated with coatings regulated under five separate Regulation 8 rules. The rules include the two rules identified in the 2001 Plan (Rules 14 and 19) as well as three other rules. The three additional rules are Rule 4: General Solvent and Surface Coating Operation, Rule 31: Surface Coating of Plastic Parts and Products, and Rule 43: Surface Coating of Marine Vessels. As a result of the expansion of this measure, the emission reductions from the amendments to these five rules are expected to be 2.1 tons/day, rather than the 0.3 tons expected when the plan was prepared.

The proposed amendments set a VOC standard for surface preparation and cleaning solvents of 50 grams per liter. This is between 5 and 7 percent, by weight, of solution. Some organic compounds are allowed because they have a negligible contribution to photochemical reactivity, and therefore do not count toward the 50 gram per liter limit. These compounds are often called "exempt compounds." Only compounds that do not contribute to stratospheric ozone depletion and are not toxic are treated as exempt in accordance with the Board's 1993 Stratospheric Ozone Policy. Staff have identified numerous cleaning solutions, some aqueous and some based on exempt solvents, that are currently available to meet the proposed standards.

An environmental impact analysis has been conducted in accordance with the provisions of the California Environmental Quality Act. This analysis, by Jones and Stokes of Sacramento, California, concluded that the proposed amendments would not have

significant adverse environmental impacts, and a Negative Declaration is proposed for adoption by the Board.

The amendments are very cost-effective, with a cost effectiveness of \$192 per ton of VOC reduced, based on considering only the cost of new equipment and without considering the cost impacts of replacement solvents. In general, because replacement solvents are less expensive when diluted for use than the organic solvents they replace, the amendments should result in overall cost savings to industry. A socioeconomic analysis has been prepared in accordance with the provisions of the California Health and Safety Code, Section 40728.5. The analysis, by Applied Development Economics of Berkeley, California, concludes that the economic and employment impacts to the Bay Area from the proposal would not be significant.

Staff discussed the proposed amendments with a Bay Area industry trade association and held a public workshop on June 20, 2002. After the workshop, staff communicated and met with many local businesses and facilities, including research and development operations, biotechnology and pharmaceutical manufacturers, and military component contractors. This proposal is based on rules already implemented in the South Coast AQMD and recently adopted in the San Joaquin Valley Unified APCD and Sacramento Metropolitan AQMD.

BACKGROUND

District Coating Rules

District surface coating rules typically focus either on a specific industry or on the type of surface being coated and impose volatile organic compound (VOC) limits appropriate for that industry or surface. Examples of industry-specific rules in Regulation 8 are Rule 14: Surface Coating of Large Appliances and Metal Furniture and Rule 43: Surface Coating of Marine Vessels. These rules regulate very specific operations. Rules that focus on the surface being coated regulate a broader range of industries. Examples include Rule 19: Surface Coating of Miscellaneous Metal Parts and Products and Rule 31: Surface Coating of Plastic Parts and Products.

Each District coating rule contains specific allowable VOC content limits and spray application equipment limitations. Rules typically require use of covered containers to minimize solvent evaporation from storage, wipe cleaning, and clean up. However, only a few of the coating rules regulate the solvents used for clean-up or surface preparation.

Rule 4

The requirements now found in Rule 4 were added to District Regulation 3 in 1974 and were subsequently amended many times. Regulation 3, which later became Regulation 8 after recodification in 1980, was the District's first organic compound regulation and was

originally adopted in 1967. In the absence of other surface coating rules, Rule 4 applies to any solvent or surface coating operation. However, with the adoption over time of coating requirements for specific industries or surfaces, Rule 4 has applied to fewer and fewer sources. After the rule was recodified in 1980, it was amended in 1982 and 1994. In 1996, the rule was amended to require: (1) that VOC emissions not exceed 5 tons per year, or (2) that emissions be reduced by 85% through use of an abatement device, or (3) that emissions be reduced through the use of a surface coating that contains no more than 420 grams VOC per liter (3.5 lbs per gallon).

Rule 14

Rule 14 applies to the surface coating of large appliances and metal furniture and was derived from two EPA Control Technology Guidelines (CTG's), one for coating of metal furniture¹ and the other for coating of large appliances.² Rule 14 was adopted in 1979 and amended in 1982, 1984, 1987, 1989, 1993, and 1994. The 1982 and 1984 amendments adjusted the VOC limits and compliance dates in the rule. The 1987 and 1989 amendments further reduced emissions, and the 1993 and 1994 amendments addressed EPA policy issues. This evolution, where initial difficulties are followed by technical innovation and acceptance of low-VOC technology and then by fine-tuning, is typical of District surface coating rules.

Rule 19

Rule 19 applies to the coating of miscellaneous metal parts and products and was adopted in 1980. The rule is based on the EPA CTG, "Control of Volatile Organic Compounds from the Surface Coating of Metal Parts."³ The metal parts rule was particularly important in the Bay Area in regulating the large quantity of emissions associated with manufacturing of computer housing and military specification equipment. The rule was amended in 1981, 1984, 1985, and 1987 to revise VOC limits and exemptions; in 1989 and 1994 in response to the EPA policy concerns; and in 1993 to mandate transfer-efficient application methods.

Rule 31

Rule 31 applies to the coating of plastic parts and was adopted in 1983. The rule was modeled after Rule 19 and was intended to control emissions from the developing computer industry in the Bay Area. Many painting job shops had grown up around the San Francisco/San Jose Silicon Valley area to coat metal or plastic computer boxes and parts for aircraft and military applications. Rule 31 was amended in 1987, 1989, 1993, and 1994 for the same reasons as the metal parts rule.

¹ EPA-450/2-77-032; US EPA; 1977

² EPA-450/2-77-034; US EPA; 1977

³ EPA-450/2-78-015, US EPA, 1978

Rule 43

Rule 43 applies to the surface coating of ships, barges, submarines, offshore oil platforms and other items subject to a marine environment. The rule was adopted in 1988 and amended in 1993 and 1994 to satisfy EPA policy concerns. The rule was amended again in 2001 to add a narrow exemption for surface coating of a historic, docked wooden ship that serves as a museum. Rule 43 was the model for the EPA's 1994 Alternative Control Techniques Document: Surface Coating Operations at Shipbuilding and Ship Repair Facilities,⁴ and subsequent CTG.

Ozone Plans

The Bay Area District is designated as a nonattainment area for the federal and California one-hour ozone standards. Ozone, a criteria pollutant, is formed from a reaction of volatile organic compounds and oxides of nitrogen in the presence of ultraviolet light (sunlight). Both federal and California law require the preparation of attainment plans for achieving respective state and federal standards. The Bay Area 2001 Ozone Attainment Plan is the District's most recent federal ozone plan. The Plan contains new transportation, mobile source, and stationary source control measures. Measure SS-13 is a commitment to adopt VOC standards for surface preparation and clean-up solvents in District Regulation 8, Rule 14: Surface Coating of Large Appliances and Metal Furniture and Rule 19: Surface Coating of Miscellaneous Metal Parts and Products.

The District's most recent plan for the California ozone standard is the Bay Area 2000 Clean Air Plan. The 2000 Clean Air Plan was adopted by the District Board of Directors on December 20, 2000.⁵ The plan included a measure, Control Measure #A-5, essentially identical to that included in the 2001 federal plan. The proposed amendments will implement both control measure SS-13 from the 2001 federal plan and control measure A-5 from the 2000 State plan.

PROCESS DESCRIPTION

Paint application requires a very clean, neutral surface, especially for the application of low-VOC two-component and 100% solids powder coatings. Dust, traces of water, particles with an ionic charge, or even fingerprints will create adhesion problems or visible marks that show through the surface of the coating film. Painters use a variety of techniques to prepare a surface for coating. Parts may be sandblasted, pressure washed, or treated with a series of dip tanks to remove soils. Any rinse must be thoroughly dried to prevent flash rusting of ferrous parts. Metal or plastic might be wiped with solvent. Solvents used for wipe cleaning include acetone, d-limonene, and paint thinner or reducer.

⁴ EPA-453/R-94-032; US EPA; April, 1994

⁵ Bay Area 2000 Clean Air Plan and Triennial Assessment, December 2000, BAAQMD

Cleaning solutions clean by interacting with soils in such a way as to lift them from a surface. This occurs when the soil has more affinity for the solution than it does for the surface. Inorganic soils tend to be hydrophilic, meaning water-loving, and they dissolve effectively in water and other polar solvents such as alcohols. Organic soils, such as greases, waxes and oils, are considered hydrophobic, meaning water-hating. They tend to dissolve more effectively in non-polar organic solvents like mineral spirits. Other considerations in any type of cleaning include the substrate, cleanliness requirements, drying requirements and environmental constraints.⁶

Types of Cleaning Solutions

Low-VOC surface preparation products generally fall into one of three classes: (1) aqueous solutions, where an organic solvent is diluted in water, (2) aqueous solutions where there are no VOC's, and (3) exempt solvent solutions.

Aqueous Solutions

Aqueous solutions may be acidic (low pH, 0 to 6), neutral (pH near 7), or alkaline (high pH, 8 to 14). Acidic solutions tend to be most useful for removing contaminants like scale or mineral salts. They are usually not the best choice for cleaning greases and oils, which are more typical of contaminants that must be cleaned in preparation for surface coating. Neutral solutions generally contain surfactants and may contain corrosion inhibitors or dispersants, which help prevent soils from re-depositing on the surface. Alkaline solutions also contain surfactants, which serve to reduce the surface tension of soils, allowing water to loosen and dissolve them. Alkaline solutions, too, can contain corrosion inhibitors. Very alkaline solutions are caustic and can remove carbon deposits. However, caustic solutions could be corrosive on plastic surfaces. More mildly alkaline solutions, with a pH in the 8 to 11 range, are abundant and suitable for oil and grease – the type of soils typically encountered in surface coating.

Organic Solvents

As noted, organic solvents may be used for cleaning either as pure solvent or in aqueous solutions. Organic compounds such as esters, terpenes, and alcohols tend to be water soluble and may be used to produce water based cleaning compounds that have many of the cleaning attributes of organic solvents.

Conventional organic solvent wipe cleaning is mostly done with acetone, isopropyl alcohol, d-limonene, or paint thinner. Of these conventional solvents, only acetone is exempt from consideration as a VOC and could be used undiluted under the proposed

⁶ Kanegsberg, Barbara, Overview of Cleaning Agents, Handbook for Critical Cleaning, CRC Press, 2001

amendments. Acetone is a ketone. Ketones are typically found as solvents in paints, and because solvents in the same family are generally compatible, acetone would tend not to interfere with paint film formation if small amounts remain on a surface. Acetone is also an effective, quick solvent for oils and greases. Acetone, however, also evaporates very quickly, is highly flammable, and odorous.

Isopropyl alcohol, or isopropanol, is not exempt from consideration as VOC. It is particularly good at cleaning fingerprints, is also moderately good at cleaning oils and greases, and does not evaporate as quickly as acetone. It also has a distinct odor and is flammable. It is also soluble in water, so can be rinsed and dried to produce a residue free surface.

d-Limonene, or 1-methyl-4-(1-methylethenyl) cyclohexene, is derived from citrus. It has a pleasant odor and is not drying to the skin like acetone or isopropyl alcohol. It has a very low evaporation rate. This makes it good for cleaning items that require soaking, but less effective for wipe cleaning as any residue would be slow to evaporate. It has good solvency characteristics but is not an exempt solvent. Although it is not soluble in water, a solution can be made by mixing it with a surfactant, so it can be used to create low-VOC aqueous cleaning solutions that evaporate much more quickly than pure d-limonene. There are many household cleaning products based on this technology.

Thinner, or reducer, supplied by a paint company has the advantage of being most likely compatible with a coating subsequently applied. Also, ordering is simplified because it can be combined with paint orders. A blend of solvents that vary with manufacturer, thinners could be expected to be somewhat more expensive than individual solvents. This may be outweighed by the ease of ordering.

Cleaning Process

Surface preparation for coating often relies upon wipe cleaning. Wipe cleaning is the wetting of a cloth with a cleaning solution accompanied by a physical rubbing process. The rubbing process serves to expedite solvent contact and lift the soil off the surface. The success depends on the ability of a cleaning solution to dislodge or dissolve the soil so that it can be easily picked up by a cloth in a short amount of time.

Cleaning solutions must generally be removed after wipe cleaning. Alkaline solutions are usually rinsed, but any solution, regardless of pH, may require rinsing. Rinsing of a part in preparation for surface coating is an important step to obtain a residue-free surface for coating. Even organic solvents might require rinsing if they have a low evaporation rate, and therefore would tend to leave a residue. Quick and thorough evaporation of water or solvent is important to minimize turn-around time. Many coating operations have ovens to bake or cure coatings. These ovens can be used to dry rinsed or wiped parts in preparation for painting.

SUMMARY OF REGULATORY PROPOSAL

Proposed Requirements

The proposed changes are:

- Titles have been modified to clarify that the rule applies to surface preparation as well as coating of the applicable substrate.
- The description of each rule has been expanded to include control of volatile organic compounds used in surface preparation and clean up of applicable substrates.
- Some clarifying language has been added for aerosol coatings, as there are now VOC standards for aerosol coatings in the California Code of Regulations.
- A definition of surface preparation has been added, with a reference to operations subject to Rule 16, which regulates cleaning in sinks, baths, and other types of degreasing machines.
- The Volatile Organic Compound content definition has been modified to state that the VOC content of solvents is determined by subtracting the weight of water and any exempt solvents from the weight of VOC; but, unlike coatings, the volume of VOC is not subtracted from the total solvent volume.
- A standard of 50 grams per liter (0.42 lbs per gallon) VOC has been added for surface preparation solvents.
- A standard of 50 grams per liter (0.42 lbs per gallon) VOC has been added for clean up solvent, except where solvent can be pressurized through spray equipment without the use of atomizing air and collected and stored in closed containers for recycling or offsite disposal.
- The standard sections of each rule prohibiting specification of non-compliant coating and requiring that manufacturers of coatings provide VOC data has been expanded to include solvent.
- The record keeping section of each rule has been modified to require monthly records of solvents used for surface preparation and clean up.
- A reference to the District test method to evaluate the VOC content of solvents has been added.
- Exemptions have been added to each rule to exempt specialized cleaning for which the standards are inappropriate.

Exemptions

The nature of the surface preparation and cleanup to be regulated by the five rules varies from rule to rule, but there are some cleaning issues common to all the rules. As a result, some proposed exemptions appear in all or several of the rules to be amended and others appear only in one rule. These exemptions have been developed after extensive discussion with the affected industries. In general, the exemptions are similar to those found in rules adopted by other air districts, though some operations are unique to the Bay Area, and, as a result, some of the proposed exemptions are not found in rules from other districts. On the other hand, broader general exemptions appear in rules adopted by other districts but do not appear in the Bay Area proposal.

Exemptions Common to All Rules

Some general exemptions are found in all the rules:

- **Stripping of cured inks, coatings, and adhesives and cleaning of application equipment**

Rationale: Successful cleaning varies with the solvency characteristics of the particular resin, ink, adhesive or coating; an incompatible solvent may curdle or set coating inside a spray gun or paint line, rendering it unusable.

- **Surface preparation associated with research and development operations, performance testing, and quality control**

Rationale: Typically, these types of operations use little solvent, but even microscopic residue must be accounted for to avoid interference with analytical equipment.

Exemptions Found in More Than One Rule

- **Electronic components and electrical equipment (Rules 4, 14, and 19)**

Rationale: Aqueous solutions are conductive, and any moisture remaining after cleaning could damage or destroy electrical components or equipment. Many electrical components are printed circuit boards. Most cleaning of PC boards is done with water or aqueous solutions. Some small amount of solvent cleaning is necessary to remove maskant or adhesive for the hand installation of components. This is done using very small amounts of solvent, usually isopropyl alcohol and sometimes acetone, often using Q-tips.

- **Medical devices** (Rules 4, 14, 19, and 31)

Rationale: Medical devices and pharmaceutical operations are often required by the Food and Drug Administration or National Institute for Health to use isopropyl alcohol and occasionally other solvents for disinfection.

- **Parts subject to military contract** (Rules 19, 31, and 43)

Rationale: Most military contractors produce their components under very prescriptive military specifications, which are required by Executive Orders to comply with local or state environmental ordinances but only after testing to qualify alternatives to specifications. The proposed exemption would allow on-going contracts to be fulfilled under existing specifications for solvent cleaning while alternatives are being qualified.

- **Adhesive bonding of dissimilar substrates** (Rules 19, 43)

Rationale: Adhesive bonding requires residue free surfaces and the use of solutions compatible with both substrates, such as metal and plastic.

- **Optics** (Rules 4, 31)

Rationale: Cleaning often requires specific solvents compatible with unique plastics to prepare surfaces for calibration and optical coatings.

Exemptions Unique to One Rule

- **Numismatic dies** (Rule 4)

Rationale: The US Mint in San Francisco must use a small amount of solvent to clean dies periodically in the manufacturing of proof coin sets.

- **Operations subject to other Regulation 8 rules** (Rule 4)

Rationale: Rule 4 applies to any operation specifically exempt from or not addressed in other Regulation 8 surface coating rules. Rule 4 standards for surface preparation solvents would apply to those operations in the absence of this exemption. Most of these operations are specialized and an examination of their unique technology is necessary before proposing surface preparation standards. Solvent emissions from wipe cleaning would still be subject to the overall emission limitations in Rule 4. This structure also gives staff the latitude to investigate technology for surface preparation standards appropriate for those rules at some later date.

- **Cleaning of production machinery** (Rule 4).

Rationale: A one year delay in the standards is proposed for the cleaning of production machinery. Operators usually like to clean production machinery with

mineral spirits, reportedly because it provides some degree of corrosion protection and lubrication. However, many alternative low-VOC solvents, particularly water based cleaners, have corrosion inhibitors added. The proposed one year exemption gives operators more time to investigate alternatives if production machinery is wipe cleaned.

- **Specific surfaces for US Navy nuclear submarines (Rule 43).**

Rationale: Specific components require very precisely engineered surfaces, some of which have to undergo rigorous material testing to be accepted. Exemptions have been proposed for gears, turbines, turbine generators and associated housings with faying (meeting) or working surfaces where surfaces are required to undergo material testing or application of transfer dyes for testing. These exemptions fulfill specific needs and help mitigate some of the costs of wholesale solvent change-over.

EMISSION REDUCTIONS

Control Measure SS-13 in the 2001 San Francisco Bay Area Ozone Attainment Plan estimates a reduction of 0.3 ton VOC per day from a 0.5 ton per day inventory for the categories of miscellaneous metal parts and products and large appliances and metal furniture. This is a 60% reduction.

The refined Year 2000 inventory estimates a 0.44 ton per day inventory for these two categories plus 0.24 ton per day emissions from plastic parts and products and 0.07 ton per day from marine vessel coating. These four categories total 0.75 ton per day. In addition, staff estimate an additional 3 ton per day inventory from the unspecified wipe cleaning subject to Regulation 8, Rule 4: General Solvent and Surface Coating Operations. The total inventory affected by the amendments is therefore 3.75 tons per day. The total emission reduction, including the effect of proposed rule exemptions, is 2.1 tons VOC per day. A complete description of the derivation of the emission inventory and emission reduction calculations is found in Appendix I.

ECONOMIC IMPACTS

Equipment Costs

Some solvent users will purchase equipment to reduce the volume of spent cleaning solution for disposal. For the purposes of the cost estimates, staff assume that one third of the facilities will purchase a distillation or evaporative unit to comply with the proposed amendments. Another third would comply by the use of exempt organic compounds that would be handled in the same way that existing, non-exempt organic solvents are handled, incurring no new equipment costs. The remaining third would already have distillation or evaporative units and would also incur no new equipment costs. The District's databank lists 308 permitted facilities subject to the four specific

surface coating rules and an additional 332 permitted facilities in the unspecified handwiping category for a total of 640 facilities.

The equipment cost for an evaporator to process aqueous solvent is about \$3000.

Equipment costs for the one third of the 640 facilities (213) that would need to purchase new equipment in the Bay Area would be as follows:

$$\text{Total equipment cost} = 213 * \$3000 = \$639,000$$

$$\text{Total cost } (\$639,000) \text{ annualized over a 10 year period, at 10\% interest} = \$1,009,000.$$

$$\text{Assuming a 250 day work year, equipment costs per day} = \$404.$$

Solution Costs

Aqueous solutions, as sold, are more expensive than conventional organic solvents. However, they are sold in concentrated form and, when diluted for use, can actually save money. The following are typical representative prices of conventional organic solvents used for wipe cleaning. The prices are based on a 5 gallon container size:

Cost of Conventional Solvents

Solvent	Price per gallon
Isopropyl Alcohol	\$10.00
Methyl Ethyl Ketone	\$13.00
d-Limonene	\$16.00
Thinner/reducer	\$10.00
Average Price	\$12.25

Replacement cleaning solutions are typically sold in concentrated form and diluted with water for use. Dilution ratios range from 1% solution in water to 40% solution in water. The following table lists representative prices from a variety of vendors for their product, as sold in 5 gallon or greater size. All products examined fell within these prices and dilution ratios.

Cost of Alternative Solutions

Product	Price per gallon	Dilution ratio	Price/gal as used
Acetone	\$ 9.00	None, exempt VOC	\$9.00
Methyl acetate	\$16.00	None, exempt VOC	\$16.00
Aqueous organic #1	\$14.55	5%	\$0.72
Aqueous alkaline #2	\$11.54	20%	\$2.31
Aqueous alkaline #3	\$10.00	2%	\$0.20
Aqueous neutral #4	\$ 6.80	33%	\$2.27
Aqueous acidic #5	\$10.00	33%	\$3.33
Aqueous neutral #6	\$30.00	5%	\$1.50
VOC-exempt blend #7	\$18.00	None	\$18.00
Aqueous organic #8	\$29.67	40%	\$11.87
Aqueous organic #9	\$12.00	20%	\$2.40
Aqueous alkaline #10	\$38.00	5%	\$1.90

The average of the table for replacement cleaning solvents is \$5.79 per gallon as used. The median price for replacements is between \$2.31 and \$2.40 per gallon. In both cases these represent a cost savings over the use of organic solvent. Even if acetone were selected, as an exempt replacement, the cost would be slightly less than the most often used organic wipe cleaning solvents, isopropyl alcohol and thinner/reducer. Acetone is commonly used now for this purpose.

Recycling/Disposal Costs

Organic solvents that are not evaporated must be disposed of as hazardous waste. Even if solvents contaminated with soils are recycled or distilled for re-use, the sludge must be disposed of as hazardous waste.

Water based cleaning solutions that are sufficiently contaminated with greases, oils, rust, scale or fine metal particles also must be disposed of as hazardous waste. Some facilities have evaporation or distillation systems that allow reduction in the volume of material that must be recycled or disposed of as hazardous waste. Only the remaining sludge from this type of aqueous system must be disposed of as hazardous waste.

Cost Effectiveness

Without consideration of potential savings from the replacement cleaning solutions, the cost effectiveness of this proposal is:

$$\$404 \text{ per day} / 2.1 \text{ tons emission reduction per day} = \$192 \text{ per ton}$$

Factoring in the cost of less expensive replacement solvents produces a cost savings.

SOCIOECONOMIC IMPACTS

Subdivision (a) of the Health and Safety Code, Section 40728.5 states, “Whenever a district intends to propose the adoption, amendment, or repeal of a rule or regulation that will significantly affect air quality or emissions limitations, that agency shall, to the extent data are available, perform an assessment of the socioeconomic impacts of the adoption, amendment, or repeal of the rule or regulation.” A socioeconomic impact analysis has been prepared by Applied Development Economics, of Berkeley, California. Affected businesses include metal and plastic parts fabricators in a variety of SIC codes.

The analysis is based on the worst case scenario. It analyzes the cost impact of equipment but does not account for potential savings due to replacement solvents. The socioeconomic analysis found that the proposed rule amendments will primarily impact 588 manufacturing and wholesale businesses in the Bay Area, at an estimated cost of \$640,000. This equates to \$1,014,917 annualized over a ten year period. If the businesses absorb all of these costs, they would experience less than a one percent drop in profits. This is not considered significant. The complete socioeconomic impact analysis is found in Appendix II.

INCREMENTAL COSTS

Health and Safety Code, Section 40920.6 requires the District to (1) identify one or more control options which achieves the emission reduction objectives for the proposed revision, (2) review the information developed to assess the cost effectiveness of the potential control option, and (3) calculate the incremental cost effectiveness for the potential control options. To determine incremental cost effectiveness, the District must “calculate the difference in the dollar costs divided by the difference in the emission reduction potentials between each progressively more stringent potential control option as compared to the next less expensive control option.” Where only one control option is identified, no incremental cost analysis need be performed.

Only one control option developed: the replacement of organic solvents used for wipe cleaning with solvents that can meet an aqueous standard of 50 g/l. This control option minimizes the organic emissions from surface preparation and cleanup solvents. Another more expensive option, the use of abatement technology to control emissions, is allowed by the proposal. This is not the required option. There are no other options identifiable that meet the emission reduction targets of this control measure. To implement an alternative standard, such as 100 g/l or 200 g/l, would not reduce emissions to an equivalent level. More importantly, such an option would still require a changeover in cleaning solutions used, at a cost comparable to the control option proposed (50 g/l standard). As only one control option has been identified, the analysis is not required.

ENVIRONMENTAL IMPACTS

The District is required to adhere to the requirements of the California Environmental Quality Act in adoption of District rules. The adoption of the proposed amendments will create an environmental benefit due to a reduction in volatile organic compound emissions, and reduced exposure of workers to some hazardous solvents. Jones and Stokes of Sacramento, California has prepared an environmental analysis of the proposed amendments. They conclude that the project would result in no adverse impacts. The complete analysis is attached as Appendix III. A Negative Declaration for the proposed amendments has been prepared and circulated for comment. Staff recommend the adoption of the Negative Declaration for the proposed amendments.

REGULATORY IMPACTS

Section 40727.2 of the California Health and Safety Code requires an air district, in adopting, amending, or repealing an air district regulation, to identify existing federal and district air pollution control requirements for the equipment or source type affected by the proposed change in district rules. The district must then note any differences between these existing requirements and the requirements imposed by the proposed change. Where the district proposal does not impose a new standard, make an existing standard more stringent, or impose new or more stringent administrative requirements, the district may simply note this fact and avoid the analysis otherwise required by this law.

There are no federal standards for these types of surface preparation operations. The only District regulations to have an effect are standards associated with permits and with increases in emissions; Regulation 2: Permits, Rule 1: General Requirements and Rule 2: New Source Review. These rules provide the vehicle to limit the amount of emissions and of emissions increases, but do not in themselves directly set standards for the VOC content or types of solvents used. No other District regulations apply. Therefore, the analysis required by Section 40727.2 does not apply.

DISTRICT STAFF IMPACTS

This proposal is not expected to result in any direct impacts on District staff. No additional staff will be required to inspect and enforce the additional requirements at existing permitted facilities. Inspection and enforcement procedures to determine compliance are consistent with existing practices and training. Because the amendments may affect some facilities that do not have permits, there may be additional permits to process and additional inspections to conduct. However, the applicability of permitting requirements is not proposed to be changed. This means that the facilities that may come into the system should be in the system currently.

RULE DEVELOPMENT PROCESS

The proposed amendments to these five District rules have been discussed at a public workshop on June 20, 2002. Comments on potential environmental impacts have also been received and considered. Staff visited facilities potentially affected by the proposal, including Lawrence Livermore Laboratories, Sandia National Labs, Northrup Grumman, Genentech and the US Mint. Potential impacts were considered and incorporated into final regulatory language. Written comments, questions and staff responses have been incorporated into this staff report in Appendix IV.

CONCLUSION

The proposed amendments to Regulation 8, Rules 4, 14, 19, 31, and 43 are based on technology currently available and already employed by numerous facilities. The amendments will reduce volatile organic compound emissions by 2.1 tons per day and will satisfy control measure SS-13 in the 2001 San Francisco Bay Area Ozone Attainment Plan for the 1-Hour National Ozone Standard. The proposed amendments are consistent with rules adopted in the Los Angeles area, the San Joaquin Valley and the Sacramento area.

Pursuant to the California Health and Safety Code, Section 40727, regulatory amendments must meet findings of necessity, authority, clarity, consistency, non-duplication, and reference. The proposed amendments are:

- Necessary to limit emissions of Volatile Organic Compounds from surface preparation and clean up solvents, and necessary to meet the requirements of Control Measure SS-13 in the District's proposed 2001 San Francisco Bay Area Ozone Attainment Plan For The National 1- Hour Ozone Standard;
- Authorized by Sections 40000, 40001, 40702, 40725 through 40728 of the California Health and Safety Code;
- Clear, in that the rule is written or displayed so that it can be easily understood by the persons directly affected by it;
- Consistent with other District Rules and Regulations, and is not in conflict with, nor contradictory to state or federal law;
- Non-duplicative of other statutes, rules, or regulations;
- Implementing, interpreting, or making specific the provisions of California Health and Safety Code Sections 40001 (Adoption and Enforcement of Rules and Regulations) and 40702 (Adoption of Rules and Regulations).

Staff recommend adoption of the proposed amendments to Regulation 8, Rules 4, 14, 19, 31, and 43 and adoption of the CEQA negative declaration for the amendments.

APPENDIX I**Emission Reduction Calculations****Inventory**Permitted Source Inventory

The District databank lists 308 permitted facilities subject to the four specific coating rules and their associated emissions. These emissions are shown in the table below.

Emission Inventory for Surface Preparation and Clean up Solvent

Category	Emissions (tons VOC/day)
Metal Parts and Products	0.33
Large Appliances and Metal Furniture	0.11
Plastic Parts and Products	0.24
Marine Vessels	0.07
Total	0.75

Area Source Inventory

Based on a CARB report by Pechan and Associates titled, "Solvent Cleaning/Degreasing Source Category Emission Inventory"⁷, projected Bay Area 2000 emissions from wipe cleaning not associated with specific source categories are 9.95 tons per day of total organic compounds, of which 4.71 tons are *reactive* organic compounds. The District databank lists 332 facilities as having permits for unspecified wipe cleaning operations subject to Rule 4, including research and development facilities, biotechnology facilities, and pharmaceutical manufacturing operations. Additional emissions come from shops that wipe clean but probably do not have a permit from the District, either because they do not use enough solvent to need permits or because they are unaware of the permit requirements for wipe cleaning.

⁷ Solvent Cleaning/Degreasing Source Category Emission Inventory, Final Report 93-341, E.H. Pechan and Associates, Inc., August, 1996

CARB has also identified a number of SIC codes from the Pechan database that are likely to contribute to this unspecified wipe cleaning inventory.⁸

Adjustment of Wipe Cleaning Inventory

The Pechan Report was published in 1996 and based on 1993 data. For 1993, over 50% of the emissions were non-reactive compounds that would not be classified as VOC. Since that time, significant changes in solvent usage have occurred so that total solvent usage and the contribution of non-reactive compounds must be adjusted:

- TCA phase out. The Montreal Protocol and 1990 Clean Air Act Amendments require a phase-out of production of chlorinated solvents because they deplete the protective ozone shield surrounding the earth's atmosphere (stratospheric ozone). The production of 1,1,1-trichloroethane (TCA), at one time the cleaning agent of choice, was completely halted on January 1, 2002. Prior to the production halt, production reductions and excise taxes on the material quickly made TCA lose favor for use as a wipe cleaning solvent, although some still exists in critical cleaning uses in vapor degreasers, where losses to the atmosphere are controlled.
- Exemption of acetone. In the period since the Pechan Report was published, several solvents were exempted by EPA from VOC control. Among these is acetone, in 1995 declared by EPA to have a negligible contribution to photochemical reactivity.⁹ Acetone is an effective solvent on a variety of greases and soils. The use of acetone has increased since the EPA exemption.
- Pollution prevention/ health and safety issues. Emissions from handwiping solvents have decreased due to economic pressures, pollution prevention measures, fire and safety concerns, and to protect workers' health. At the same time, various aqueous cleaning compounds and low volatility formulations like citrus based cleaners (d-limonene) have become much more readily available and accepted.

The net result, taking into account all of these considerations, is that total emissions from handwiping solvents have decreased while the relative percentage of reactive organic compounds in solvents used for wipe cleaning has increased. District staff estimate that

⁸ Hand and edge tools (3423); hardware (3429); fabricated plate work (boiler shops) (3443); screw machine products (3451); bolts, nuts, screws, rivets and washers (3452); iron and steel forging (3469); electroplating, plating, polishing, anodizing and coloring (3471); industrial valves; fluid power valves and hose fittings (3492); fabricated pipe and pipe fittings (3498); steam, gas and hydraulic turbines, and turbine generator set units (3511); special tools and dies, die sets, jigs and fixtures and industrial molds (3544); cutting tools, machine tools and accessories and machinists' precision measuring devices (3545); industrial and commercial fans and blowers and air purification equipment (3564); air conditioning and warm air heating equipment and commercial and industrial refrigeration equipment (3585); motors and generators (3621); and fasteners, buttons, needles and pins (3965).

⁹ 60 FR 31633

handwiping emissions are now 5 tons per day, and that the reactive organic compound emissions portion of that category is 3 tons per day.

Reductions

The total preliminary emission reduction is calculated as follows:

$$\text{Emission Reduction} = \text{Emission Inventory} * \% \text{ Subject to Control}^{10} * \% \text{ Control}^{11}$$

Emission Inventory, surface preparation and clean up solvent:

Metal Parts and Products	0.33 * 75% * 93%
Large Appliances and Metal Furniture	0.11 * 75% * 93%
Plastic Parts and Products	0.24 * 75% * 93%
Marine Vessels	0.07 * 75% * 93%
	<u>0.75 * 75% * 93% = 0.52 tons per day</u>
General Solvent and Coating	<u>3.00 * 60% * 93% = 1.67 tons per day</u>
	= 2.19 tons per day

¹⁰ The 75% Subject to Control Factor is derived from estimates of the amounts of organic solvent emissions that are listed in the emission inventory for various facilities and that would be subject to the proposed standards.

The remaining 25% of emissions for these facilities comes from exempt cleaning of pressure pot spray equipment and solvent evaporation due to open cleaning solutions during mixing of concentrate.

For facilities subject to Rule 4, electrical and medical devices are exempt from the surface preparation standards. This is the rationale for the 60% factor used for emissions subject to control for Rule 4 instead of 75%.

Emissions from facilities that are already using low VOC solvents for surface preparation and cleaning activities are not part of the Subject to Control factor, because this reduction has already been taken into account in the inventory based on annual facility reports.

¹¹ The 93% Control Factor is derived from the proposed VOC standard, 50 grams per liter. A change from the use of isopropyl alcohol (785 g/l) to a 50 g/l solvent is a 93% reduction. The other major organic solvent used, paint thinner/reducer, has a VOC content that varies with manufacturer, but is comparable to that for isopropyl alcohol.

This total must be adjusted to account for the effect of exemptions¹²:

The total of the VOC emissions from exempt operations is approximately 0.09 tons per day. The exemption for military contractors until 2005 is responsible for an additional 0.05 tons per day and the exemption for production machinery until 2004 is responsible for an additional 0.02 tons per day. Consequently, the emission reductions attributable to the amendments, less exemptions are:

Emission Reductions
(tons VOC/day)

2003	2004	2005	2006
2.02	2.05	2.05	2.1

¹² The majority of emissions from exemptions fall into four categories. The first category, responsible for the largest amount of exempt emissions is pharmaceutical operations and medical device manufacturing. This is because of the large amount of isopropyl alcohol used as disinfectant as required by current Good Laboratory Practices or Food and Drug Administration or National Institute of Health guidelines. The emissions from wipe cleaning in these facilities, such as Genentech, Chiron and Ortho-McNeil Pharmaceutical Company are about 0.075 tons of VOC per day.

The second is research and development operations, either from facilities dedicated to R&D, such as Lawrence Livermore Laboratories, Sandia Labs, the Stanford Linear Accelerator Center, or Chevron Research, or companies that have some research adjunctive to their production, such as Lam Research and Applied Materials. Some of these are large facilities, but the solvent use for wipe cleaning is infrequent and a tiny part of the facilities' activities.

The third category is military contractors, and the users of the specific exemptions designed for Rule 43: Marine Vessel Coating, primarily Northrup-Grumman. Of course, the number of military contracts fulfilled by Bay Area businesses varies over time, and the exemption will sunset in 2005.

The fourth category of exempt operations that is significant is optics. This is the smallest category, only a little under 3 lbs emissions per day, partly because some Bay Area facilities already use exempt solvent or do their cleaning in vapor degreasers.